CHART PROGRAM

CHART WEB R3.3
MAPPING R17.3
AVL-GPS R2.3
ATMS R17.1
DETAILED DESIGN

Version 1.0
Work Order 12 Deliverable 2
Doc# WO12-CHART-RD-002-V2.0

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Prepared by:

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Revision History

Date	Version	Description	Author
2/20/2017	1.0	Initial release	Chris Brennan, Chidi Azubike, Cesar Cheng-Robles, Randy Jenkins, Happy Sahni, Yogesh Dhanapal
3/28/2017	1.0	Update to document title, document number	Michael Fleming

1 INTRODUCTION

1.1 Purpose and Scope

1.1.1 Purpose

This document describes the design of the software for WO12 Public Facing Mobile Video Release. This release provides the features listed below. These features are being developed under work order WO 12.

The main purpose of WO12 is to make mobile video feeds from SHA maintenance vehicles available to the public during weather events. Components of CHART systems will be modified to allow AVL icons and mobile video to be displayed on the CHARTWeb Map at the discretion of SHA. Complete details are described in Sections 2 through 7 below.

MAP-558 is being included with the deployment of WO12 that addresses occasional erratic behavior of the AVL client. The changes made to the mapping AVL client are seamless and none of the CHART applications are affected. There are some additional (mapping) CHARTWeb database changes being made to consolidate the storage of the imported data and are outlined in section 3.

1.1.2 Scope

The main objective of this detailed design document is to provide software developers with a framework in which to implement the requirements identified in the WO 12 Requirements document. A matrix mapping requirements to the design is presented in Appendix A (Mapping to Requirements).

1.2 Project Executive Summary

The main objective of this detailed design document is to provide software developers with a framework in which to implement the requirements identified in the WO12 Requirements document. The overall contents of the WO12 Release are:

There are 5 classes of vehicles that may be displayed to the public:

1. SHA Maintenance (Winter Event MV1000)
2. SHA Maintenance Webtech
3. MDTA MV1000
4. MDTA Maintenance Webtech
5. CHART Emergency Response Units (MV2101 and MV1000)

The following requirements are to be implemented:

- Configure CHART AVL Server and CHART Intranet Mapping to display new MV 1000 equipped vehicles (Class 1).
- CHARTWeb Map updated to display AVL icons for the new MV1000 equipped vehicles assigned (Class 1).
- This should be done on a separate CHARTWeb Map.
- The vehicle icons should allow a user to click and view streaming video in a pop-up video window.
- The ATMS red button capability should be maintained.
- Allow for privileged user to remove AVL Icons and Mobile Video from the CHARTWeb Map.
- Ability to display/not display by AVL icons by entire set, district, or vehicle.
- CHARTWeb Map should be able to display:
- AVL Icons from Webtech (Class 2)
- MDTA Maintenance and response vehicles (Class 3,4)
- CHART ERT vehicle icons and streaming video (Class 5)

Design Process

The design reflects the Use Cases outlined in the requirements of WO 12. Details were elaborated as needed. GUI prototypes where developed to show how the WO12 requirements will be achieved.

Work Products

The final WO12 Public Facing Mobile Video design consists of the following work products:

- Human-Machine Interface section which provides descriptions of the screens that are changing or being added in order to allow the user to perform the described uses.
- Requirement Verification Traceability Matrix that shows how this design meets the documented requirements for this feature

1.2.1 System Overview

Changes for WO12 involve several systems.

At a high level current, pre-WO 12, CHART systems utilize AVL data in the following manner:

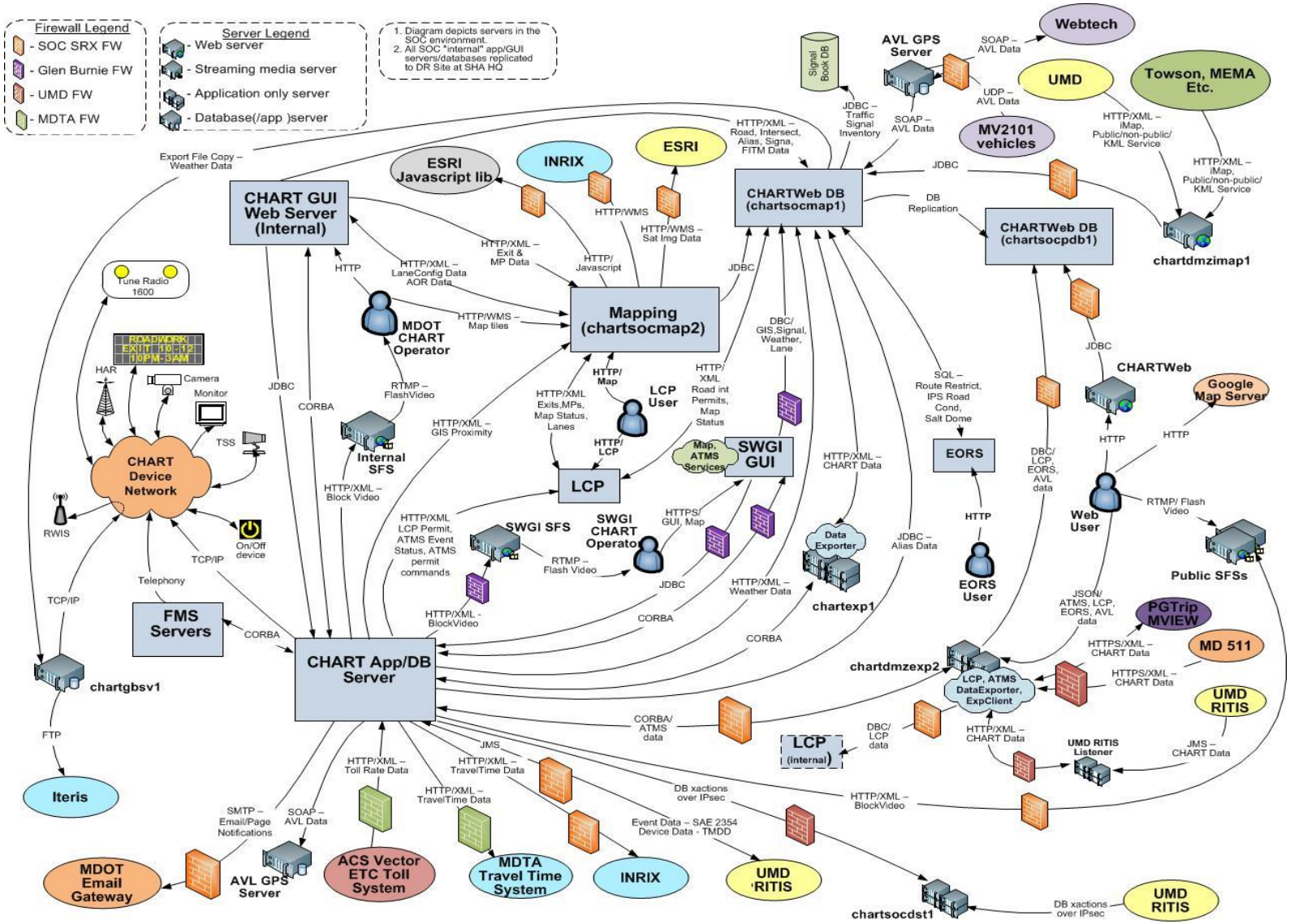
- The AVL-GPS application polls Webtech to get AVL data for Webtech equipped vehicles. Usually these are trucks, and possibly snow plows.
- CHART patrol vehicles are also AVL equipped. However, they are equipped with MV 100 and MV 2001 AVL devices, and also include mobile cameras. These MV CHART vehicles push AVL data to the AVL-GPS server via UDP.

- The AVL-GPS server has a GUI to configure certain pieces of data for AVL data received. For instance, AVL-GPS GUI users can configure a call sign for a CHART MV vehicle.
- There are two CHART applications that poll the AVL-GPS server for AVL data via SOAP interface: ATMS, and the Mapping AVL Client.
- ATMS consumes AVL data to map and track resources. This includes the ability to display video associated with vehicles.
- The AVL Client writes AVL data to the CHARTWeb database for display on the Intranet Map. This includes the ability to display video associated with vehicles.
- AVL data is also presented via secured Mapping REST feed.
- All vehicles are available for use by both ATMS and Mapping.

The main requirement for WO 12 is that AVL vehicles be available via a map interface on the public CHARTWeb. To do this, the AVL data will be available as a new Winter Operations vehicles Video map on CHARTWeb where the user's browser will pull JSON data on the external CHART ExportClient on chartdmzexp2. This is similar to how other data is displayed on the CHARTWeb Map. To do this the following updates will be made:

- The AVL-GPS server will be modified to be able to filter vehicles for public display, also specifying a public name for the vehicle. This public flag and public name will be added to the SOAP feed
- The AVL client will be modified to read the new public flag and public name from the SOAP feed and write to the CHARTWeb database.
- The Intranet Map will be modified to be able to display any MV equipped vehicle that has a camera with a black circle (which indicates that video is available for that vehicle). This expands to vehicles associated with any Shop or District and not just CHARTS vehicles.
- The CHART ExportClient will read AVL data from the CHARTWeb database and serve it up as JSON if configured to do so. The external CHART ExportClient will be configured this way.
- CHARTWeb will be modified to provide a new page, the Winter Operations Vehicles Video map to show those vehicles designated for display to the public. This page will have the ability to display specific messaging at the top. Video will be available for any video-equipped vehicles displaying.

The diagram below shows the new AVL JSON coming from chartdmzexp2.



1-1. CHART and External Interfaces

A matrix mapping requirements to the design is presented in Appendix A (Mapping to Requirements).

1.2.2 Design Constraints

No design constraints have been identified for WO12.

1.2.3 Future Contingencies

No future contingencies have been identified for WO12.

1.3 Document Organization

Section 1 of this document is the introduction.
Section 2 describes the system architecture.
Section 3 describes the file and database design.
Section 4 describes the human –machine interface
Section 5 describes the detailed design with additional detailed content
Section 6 describes the interfaces external.
Section 7 describes the system integrity controls.

1.4 Points of Contact

The key members of the staff are listed below:

CSRA Operations Manager: Sam Jallad (410-872-2120)
CSRA Program Manager: Laura Nicholas (678-861-6569)
CSRA Release Manager: Gary Krebs (678-838-9935)
System Administrator: Kenny Gross (410-582-5680)
Application Delivery Manager: Chris Brennan (410-872-2124)
ATMS Development lead: Scott Dalrymple (410-872-2128)
Database Administrator: Nach Periyanan (703-508-1308)
Configuration Manager: Delena McFadden-Mello (410-872-2122)
Configuration Manager: Mike Fleming (410-872-2127)
System Test: Mike Sluder (410-872-2129)
System Test: Asha Khatri (410-872-2130)
CHART Project Manager: Dale Lineweaver (410-582-5695)
CHART Program Administrator: Rick Dye (410-582-5619)

1.5 Project References

The following are the list of the relevant WO12 Release documents. Note that not all are updated for these specific releases:

1. *CHART Program CHARTWeb R3.3, Mapping R17.3, AVL-GPS 2.3, ATMS R17.1 Software Requirements Version 2.0,* February 10, 2017, WO12-CWEB-REQ-001-V2.0

1.6 Glossary

TERM	DESCRIPTION
AJAX	Asynchronous Javascript and XML
AOR	Area of Responsibility representing an area that a person, user, operations center, etc. is responsible for.
API	Application Programming Interface
AVL	Automated Vehicle Location
ATMS	Advance Traffic Management System
CHART	Coordinated Highways Action Response Team
CORBA	Common Object Request Broker Architecture
CCTV	Closed Circuit Television
COTS	Commercial Off The Shelf [software or equipment]
CRUD	Create, Read, Update, and Delete (the four standard actions which can be performed on a database table).
DBMS	Database Management System
DMS	Dynamic Message Sign. An electronic sign used to display information to the traveling public.
DTMF	Dual Tone Multi-Frequency (touchtone telephone signaling system)
Dynamic Message Sign	An electronic sign used to provide messages to motorists.
ERD	Entity Relationship Diagram, used to show the relationship between tables in an RDBMS
FMS	Field Management System
Functional Right	A user right, granted to CHART users via Roles. Each operation on a device, including the ability to configure a device, views its sensitive information, and issue commands to the device are controlled by user rights. Users must possess the proper right to be able to perform these actions.
GB	Gigabytes
GIF	Graphic Interchange Format (picture file)
GIS	A Geographic Information System (GIS) is any system that captures, stores, analyzes, manages, and presents data that are linked to location
GUI	Graphical User Interface
HAR	Highway Advisory Radio. A radio station used to broadcast programmable messages to motorists and other travelers regarding traffic and other delays.
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
IDL	Interface Definition Language. Describes a CORBA interface.
JAXB	Java API for XML Binding
JDBC	Java Database Connectivity
JDOM	Java Document Object Model
JNI	Java Native Interface, a means of interfacing Java programs with languages written in other languages, such as C++
JRE	Java Runtime Environment
JSON	JavaScript Object Notation

TERM	DESCRIPTION
JTS	Java Topology Suite
KB	Kilobytes
LCP	Lane Closure Permit, a permit for closure of a road for maintenance, or the system used to manage those permits.
MB	Megabytes
MSSQL	Microsoft SQL [Server], the DBMS used in CHART.
NSIS	Nullsoft Scriptable Installation System
PDF	Portable Document Format
PR	Problem Report
RDBMS	Relational DBMS
REST	Representational State Transfer
RPC	Remote Procedure Call
RV	Recreational Vehicle
SDK	Software Development Kit
SFS	Streaming Flash Server
SHA	State Highway Administration
SNMP	Simple Network Management Protocol
SOC	Statewide Operations Center
SQL	Structured Query Language
TSS	Traffic Sensor System
UCD	Use Case Diagram. Depicts a collection of Use Cases.
UML	Unified Modeling Language
XML	Extensible Markup Language

2 SYSTEM ARCHITECTURE

The sections below discuss specific elements of the architecture and software components that are created, changed, or used in the WO12 Release.

2.1 System Hardware Architecture

WO12 features do not impact the hardware architecture of the CHART system.

2.2 System Software Architecture

WO12 features do not impact the overall software architecture of the CHART system.

2.2.1 COTS Products

No new COTS products are added for WO12.

2.2.2 Component Deployment

The CHART Export Client now has a configurable AVL component to the JSON feed. This will be deployed on the external CHART ExportClient on chartdmzexp2.

2.2.3 Internal Interfaces

This section describes the internal interfaces added or modified in the WO12 Release.

1. The AVL GPS Server interface and XML SOAP Device requests are updated with two new fields: Public Display Flag and Public Display Name. These fields will be utilized by the CHARTWeb Public Map to control the display of specific vehicle(s) on the public facing map. Vehicle grouping and filtering by AVL Vehicle Class and/or District will also be available on the AVL GPS Server interface.
2. A new JSON data feed is available in the external CHARTExportClient to provide AVL data to the CHARTWeb Map.
3. Mapping AVL client will import the two new fields (Public Display Flag and Public Name) and will store them in the CHARTWeb database.
4. A new Winter Operations Vehicles Live Video Map interface for the CHARTWeb. This map lets you track the vehicles in real time on the map. Vehicles with a black circle have video, and vehicles without a black circle have no video.

2.3 Internal Communications Architecture

The overall internal communications architecture of the CHART system is not changed for WO12 except that the CHART ExportClient will read the CHARTWeb database to get AVL data to serve as JSON.

3 FILE AND DATABASE DESIGN

3.1 Database Management System Files

3.1.1 CHARTWeb Database

3.1.1.1 Overview

For WO12 there is one modified view, two new tables and one removed table.

3.1.1.2 Database Architecture

Except as noted, WO12 does not impact the overall architecture of the CHARTWeb database.

3.1.1.2.1 Logical Design

3.1.1.2.1.1 Table Definition Report –

In tables shown below:

- Deleted columns/constraints marked with a minus sign ("-")
- Modified columns/constraints marked with an asterisk ("*")
- New columns/constraints marked with a plus sign ("+")

3.1.1.2.1.1.1 Database Changes for WO12.

A new lookup table (avl_sfl_lkp) is added to the CHARTWeb database to provide a lookup for public SFS host ip address for CCTVs located on AVL vehicles.

avl_sfs_lkp Table (New)

+ avl_camera_id	VARCHAR(32) NOT NULL
+ sfs_host_ip	VARCHAR(50) NOT NULL

Primary Key (avl_camera_id)

MAP-588 adds a new table (AVL_VEHICLE) to the CHARTWeb database to provide storage of the imported inventory and status of the AVL vehicles from the GPS server.

AVL_VEHICLE Table (New)

+ VEHICLEID	nvarchar(50)	NOT NULL
+ DRIVERID	nvarchar(50)	NULL
+ DIRECTION	nvarchar(10)	NULL
+ SPEED	numeric(38, 8)	NULL
+ CONDITION	nvarchar(50)	NULL
+ BEARING	nvarchar(50)	NULL
+ REPORTTIME	datetime2(7)	NULL
+ ROUTE	nvarchar(50)	NULL

+ SEGMENT	nvarchar(10)	NULL
+ X	numeric(38, 8)	NULL
+ Y	numeric(38, 8)	NULL
+ DRIVERNAME	nvarchar(100)	NULL
+ LATITUDE	numeric(38, 8)	NULL
+ LONGITUDE	numeric(38, 8)	NULL
+ GROUPNAME	nvarchar(200)	NULL
+ GROUPID	int	NULL
+ CALLSIGN	nvarchar(50)	NULL
+ CAMERAID	nvarchar(32)	NULL
+ STREET	nvarchar(200)	NULL
+ CITY	nvarchar(50)	NULL
+ STATE	nvarchar(10)	NULL
+ ZIP	nvarchar(10)	NULL
+ PublicFlag	smallint	NULL
+ PublicName	nvarchar(255)	NULL

Existing view vw_Vehicle_basicinfo is modified to contain a flag indicating the vehicle should be displayed to the public and a name to be displayed to the public. The view consumes the imported data from the GPS Server stored in the AVL_VEHICLE table.

vw_Vehicle_basicinfo View (Modified)

+ PublicFlag	SMALLINT(32) NULL
+ PublicName	NVARCHAR(255) NULL

MAP-588 removes the existing table G_VEHICLE from the CHARTWeb database. Its use as a spatial table was deprecated a while ago, and to maintain the naming convention of spatial vs non-spatial feature data sets it has been replaced with the new AVL_VEHICLE table.

G_VEHICLE Table (Removed)

A new row is added to the WebMessages table of the CHARTWeb database to be able to receive messages from the EORS web application. The messages received from EORs will be displayed on the Winter Operations Vehicle Live Video interface.

3.1.1.2.1.2 Database Conversion

There are no data conversion / migration tasks identified for WO12.

3.1.1.2.1.3 PL/SQL Module Definition and Database Trigger Reports

There are no new PL/SQL modules for WO12.

3.1.1.2.1.4 Database Size Estimate - provides size estimate of current design

WO12 does not significantly affect the size of the CHARTWeb database.

3.1.1.2.1.5 Data Distribution

There are no changes to data distribution for WO12.

3.1.1.2.1.6 Database Replication

There are no changes to database replication for WO12.

3.1.1.2.1.7 Database Failover Strategy

There are no changes to the database failover strategy for WO12.

3.1.1.2.1.8 Reports

N/A

3.1.2 GPS Server Database

3.1.2.1 Overview

For WO12 there is one table modified in the internal AVL Postgres database.

3.1.2.2 Database Architecture

Except as noted, WO12 does not impact the overall architecture of the AVL Postgres database.

3.1.2.2.1 Logical Design

3.1.2.2.1.1 Table Definition Report –

In tables shown below:

- Deleted columns/constraints marked with a minus sign ("-")
- Modified columns/constraints marked with an asterisk ("*")
- New columns/constraints marked with a plus sign ("+")

3.1.2.2.1.1.1 Database Changes for WO12.

Existing table DEVICES is modified to include a flag indicating when the vehicle should be displayed to the public and a name to be displayed to the public. Both fields are configurable by the user on the GPS Server.

DEVICES Table (Modified)

DEVICEID	TEXT	NOT NULL
WEBTECHDEVICE	BOOLEAN	NOT NULL
PTN	TEXT	NOT NULL
IPADDRESS	TEXT	NULL
CALLSIGN	TEXT	NULL
VEHICLETAG	TEXT	NULL
VEHICLEPREFIX	TEXT	NULL
GROUPNAME	TEXT	NULL

DRIVERNAME	TEXT	NULL
CAMERAID	TEXT	NULL
+ PUBLICDISPLAYFLAG	BOOLEAN	NOT NULL
+ PUBLICDISPLAYNAME	TEXT	NULL

3.1.2.2.1.2 Database Conversion

The following db conversion / migration task is required for the AVL Postgres database in WO12:

- Existing records within the DEVICES table must be manually updated to set the PUBLICDISPLAYFLAG field to 'False' prior to startup of the AVL GPS Server.

3.1.2.2.1.3 PL/SQL Module Definition and Database Trigger Reports

There are no new PL/SQL modules for WO12.

3.1.2.2.1.4 Database Size Estimate - provides size estimate of current design

WO12 updates do not significantly affect the size of the AVL Postgres database.

3.1.2.2.1.5 Data Distribution

N/A for the AVL Postgres database in WO12.

3.1.2.2.1.6 Database Replication

N/A for the AVL Postgres database in WO12.

3.1.2.2.1.7 Database Failover Strategy

N/A for the AVL Postgres database in WO12.

3.1.2.2.1.8 Reports

N/A for the AVL Postgres database in WO12.

3.2 Non-Database Management System Files

The following describes any updates to application data files (used for input or output), that are non-DBMS.

3.2.1 ATMS

The following describes the use of flat files in CHART ATMS. Note: The CHARTExportClientSerivce is considered part of the ATMS for the purposes of this doc.

3.2.1.1 Service Property Files

Several new AVL related parameters were added to the CHARTExportClientService.props file.

#
The interval (seconds) at which the AVLDataManager updates its cache from the database.
The cache is used to provide data to the AVL JSON Data Feed.
#
Default = 60 (Min 30, Max MAX_INT_VALUE)
#
webservices.exportlistenermodule.avlDataRefreshRateSeconds=60

#
The number of minutes in the past to consider AVL data as stale and no longer include it
in the AVL JSON Data Feed. If set to 0, nothing is considered stale.
#
Default = 60 (0 = never stale, Max MAX_INT_VALUE)
#
webservices.exportlistenermodule.avlStaleDataTimeMinutes=20

#
The default AVL public CCTV IP address. This is used when updating the avl cache from the DB
only if no ip is configured for the camera in the [avl_sfs_lkp] in CHART Web DB.
#
REQUIRED
#
webservices.exportlistenermodule.avlDefaultPublicCctvIp=<IP of SFS for Video - default>

3.2.2 GPS Server

There are no specific configuration/property file updates needed for WO 12.

3.2.2.1 Service Property Files

Several properties are modified within the *config* python properties file. These properties relate to execution of the GPS Server in the lab instance when compared to the production instance.

3.2.3 CHART Mapping

3.2.3.1 AVLClient Property File

Note that added/updated fields are in **bold red**.

```
<?xml version="1.0"?>
<configuration>
```

```
  <configSections>
    <sectionGroup name="applicationSettings"
type="System.Configuration.ApplicationSettingsGroup, System, Version=4.0.0.0,
Culture=neutral, PublicKeyToken=b77a5c561934e089">
      <section name="ChartAvlWinService.Properties.Settings"
type="System.Configuration.ClientSettingsSection, System, Version=4.0.0.0, Culture=neutral,
PublicKeyToken=b77a5c561934e089" requirePermission="false" />
      <section name="CHARTAVLClientBizLogic.Properties.Settings"
type="System.Configuration.ClientSettingsSection, System, Version=4.0.0.0, Culture=neutral,
PublicKeyToken=b77a5c561934e089" requirePermission="false" />
    </sectionGroup>
    <section name="log4net" type="log4net.Config.Log4NetConfigurationSectionHandler,
log4net"/>
    <section name="entityFramework"
type="System.Data.Entity.Internal.ConfigFile.EntityFrameworkSection, EntityFramework,
Version=6.0.0.0, Culture=neutral, PublicKeyToken=b77a5c561934e089"
requirePermission="false" />
  </configSections>
  <log4net>
    <appender name="CHARTAVLClientWinServiceAppender"
type="log4net.Appender.RollingFileAppender">
      <param name="File" value="d:\logs\CHARTAVLClientWinServiceLog.txt" />
      <param name="AppendToFile" value="true" />
      <param name="MaximumFileSize" value="1GB" />
      <layout type="log4net.Layout.PatternLayout">
        <param name="ConversionPattern" value="%d [%t] %-5p %c %m%n" />
      </layout>
      <filter type="log4net.Filter.LoggerMatchFilter">
        <loggerToMatch value="CHARTAVLClientWinService.XML" />
        <acceptOnMatch value="false" />
      </filter>
    </appender>
    <logger name="CHARTAVLClientWinService">
      <level value="INFO" />
      <appender-ref ref="CHARTAVLClientWinServiceAppender" />
    </logger>
    <appender name="CHARTAVLClientWinServiceXMLAppender"
type="log4net.Appender.RollingFileAppender">
      <param name="File" value="d:\logs\CHARTAVLClientWinServiceXMLLog.txt" />
      <param name="AppendToFile" value="true" />
      <param name="MaximumFileSize" value="1GB" />
      <layout type="log4net.Layout.PatternLayout">
        <param name="ConversionPattern" value="%d [%t] %-5p %c %m%n" />
```

```
    </layout>
    <filter type="log4net.Filter.LoggerMatchFilter">
     <loggerToMatch value="CHARTAVLClientWinService.XML" />
     <acceptOnMatch value="true" />
    </filter>
   </appender>
   <logger name="CHARTAVLClientWinService.XML">
    <level value="INFO" />
    <appender-ref ref="CHARTAVLClientWinServiceXMLAppender" />
   </logger>
   <root>
    <level value="INFO" />
   </root>
  </log4net>
  <system.serviceModel>
   <bindings/>
   <client/>
  </system.serviceModel>
  <applicationSettings>
   <CHARTAVLClientBizLogic.Properties.Settings>
    <setting name="CHARTAVLClientBizLogic_gpsServerWebReference_gpsServerApp"
serializeAs="String">
       <!-- skyline feed (csra lab) -->
       <!--<value>http://10.2.110.53:7788/?wsdl</value>-->
        <!-- skyline feed (production) -->
        <value>http://10.92.196.25:7787/?wsdl</value>
    </setting>
   </CHARTAVLClientBizLogic.Properties.Settings>
   <ChartAvlWinService.Properties.Settings>
    <setting name="gpsWebSvcUserName" serializeAs="String">
     <value>chartmaster@sha.state.md.us</value>
    </setting>
    <setting name="gpsWebSvcPwd" serializeAs="String">
     <value>chartmaster1</value>
    </setting>
    <setting name="RequireStreetAdd" serializeAs="String">
     <value>0</value>
    </setting>
    <setting name="MaxAge" serializeAs="String">
     <value>10</value>
    </setting>
    <setting name="DeviceInventoryInterval" serializeAs="String">
     <value>10</value>
    </setting>
```

```
      <setting name="GpsesStatusInterval" serializeAs="String">
        <value>1</value>
      </setting>
    </ChartAvlWinService.Properties.Settings>
  </applicationSettings>
  <connectionStrings>
    <!-- (CSRA LAB) dev3 environment -->
    <!-- <add name="CHARTWEBEntities"
connectionString="metadata=res://*/CHARTWebModel.csdl|res://*/CHARTWebModel.ss
dl|res://*/CHARTWebModel.msl;provider=System.Data.SqlClient;provider connection
string=&quot;data source=chartdev3map1;initial catalog=CHARTWEB;persist security
info=True;user id=AVLClient;password=<AVL password>;
MultipleActiveResultSets=True;App=EntityFramework&quot;"
providerName="System.Data.EntityClient" /> -->
    <!-- (CSRA LAB) sys environment -->
    <!-- <add name="CHARTWEBEntities"
connectionString="metadata=res://*/CHARTWebModel.csdl|res://*/CHARTWebModel.ss
dl|res://*/CHARTWebModel.msl;provider=System.Data.SqlClient;provider connection
string=&quot;data source=chartsysmap1;initial catalog=CHARTWEB;persist security
info=True;user id=AVLClient;password=<AVL password>;
MultipleActiveResultSets=True;App=EntityFramework&quot;"
providerName="System.Data.EntityClient" /> -->
    <!-- (CSRA LAB) patch environment -->
    <!-- <add name="CHARTWEBEntities"
connectionString="metadata=res://*/CHARTWebModel.csdl|res://*/CHARTWebModel.ss
dl|res://*/CHARTWebModel.msl;provider=System.Data.SqlClient;provider connection
string=&quot;data source=chartpatchmap1;initial catalog=CHARTWEB;persist security
info=True;user id=AVLClient;password=<AVL password>;
MultipleActiveResultSets=True;App=EntityFramework&quot;"
providerName="System.Data.EntityClient" /> -->

    <!-- SOC (production) -->
    <add name="CHARTWEBEntities"
connectionString="metadata=res://*/CHARTWebModel.csdl|res://*/CHARTWebModel.ss
dl|res://*/CHARTWebModel.msl;provider=System.Data.SqlClient;provider connection
string=&quot;data source=chartsocmap1;initial catalog=CHARTWEB;persist security
info=True;user id=AVLClient;password=<AVL password>;
MultipleActiveResultSets=True;App=EntityFramework&quot;"
providerName="System.Data.EntityClient" />
  </connectionStrings>
  <entityFramework>
    <defaultConnectionFactory
type="System.Data.Entity.Infrastructure.LocalDbConnectionFactory,
EntityFramework">
      <parameters>
```

```
      <parameter value="v11.0" />
    </parameters>
  </defaultConnectionFactory>
  <providers>
    <provider invariantName="System.Data.SqlClient"
type="System.Data.Entity.SqlServer.SqlProviderServices, EntityFramework.SqlServer" />
  </providers>
 </entityFramework>
 <startup>
  <supportedRuntime version="v4.0" sku=".NETFramework,Version=v4.0"/>
 </startup>
</configuration>
```

3.2.4 CHARTWeb

There are no new or updated configuration files for CHARTWeb.

4 HUMAN-MACHINE INTERFACE

4.1 GPS Server

This section describes the interface changes to the AVL GPS Server for WO 12.

4.1.1 Public Display Flag

On the Devices and MV Devices List pages, a new checkbox column is added: Display On CHART Web. This column allows the user to toggle the end display of a device on the public map.

Figure 4-1 View Public Display Flag Column

The user may edit the Public Display Flag by clicking on the edit icon at the end of a specific vehicle row, or double clicking the row in any text field. Updates are reflected after the submit icon is clicked at the end of the highlighted edit row.

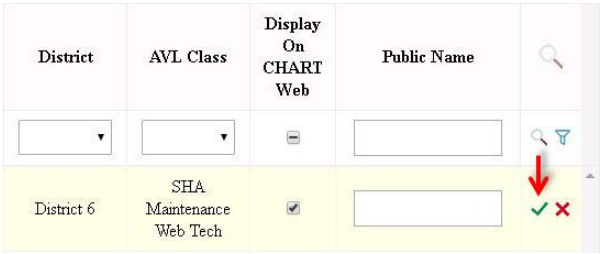


Figure 4-2 Edit AVL Vehicle For Public Display Flag

The user may also sort either device list page by the public display flag column, as well as filter the results by devices which are activated or deactivated in display on the public map.

4.1.2 Public Display Name

On the Devices and MV Devices List pages, a new text field column is added: Public Name. This column allows the user to associate a name for a vehicle viewable only on the public map.

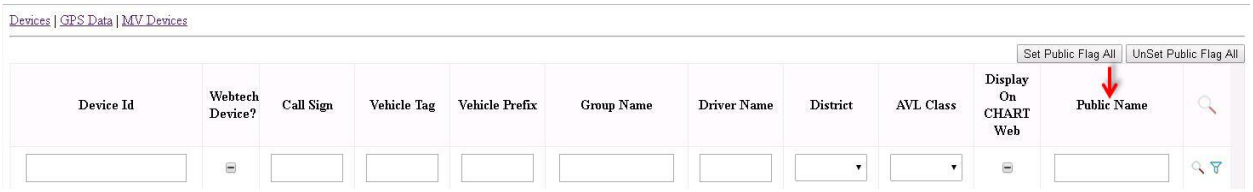


Figure 4-3 View Public Display Name Column

The user may edit and submit updates to the Public Display Name field similar to updates performed on the Public Display Flag checkbox.

Figure 4-4 Edit AVL Vehicle For Public Display Flag

The user may also sort either device list page by the public display name column, as well as filter the results by a specific public name text.

4.1.3 Filter By District

On the Devices and MV Devices List pages, a new read-only text field column is added: District. This column is derived from the AVL Vehicle Group, and displays one of the following district values if the vehicle group name matches an office or shop owned by that district:

- District 1
- District 2
- District 3
- District 4
- District 5
- District 6
- District 7
- MDTA
- OOTS
- CHART

Note: If the group name can not be matched to an office or shop within any known district, then this vehicle will be labeled with a district of "Unknown" .

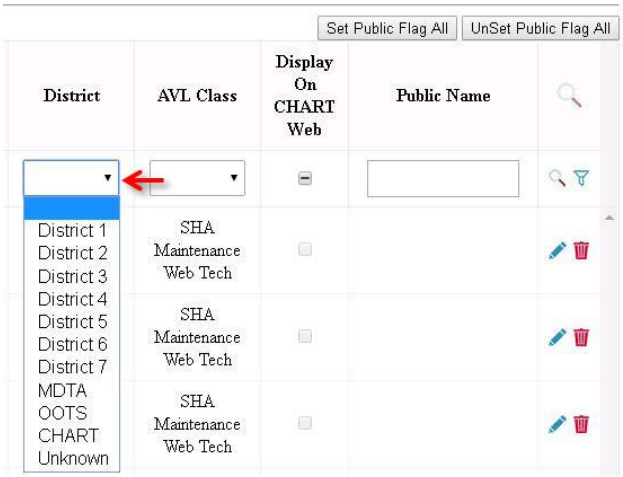


Figure 4-5 Filter AVL Vehicles By District

The user may clear the individual filter for District by selecting the blank option, or by clearing all filter fields with the Clear Filter icon at the end of the filter row.

4.1.4 Filter By AVL Vehicle Class

On the Devices and MV Devices List pages, a new read-only text field column is added: AVL Class. This column is also derived from the AVL Vehicle Group, and displays one of the following vehicle classes if the vehicle district and camera availability match the conditions for each respective class (See Use Case UC-2.0):

- SHA Maintenance (Winter Event MV 1000)
- SHA Maintenance Web Tech
- MDTA MV 1000
- MDTA Maintenance Web Tech
- CHART Emergency Response Units (MV2101 and MV 1000).

Note: If the vehicle can not be matched to a known AVL Vehicle Class then this vehicle will be labeled with a class of "Unknown" .

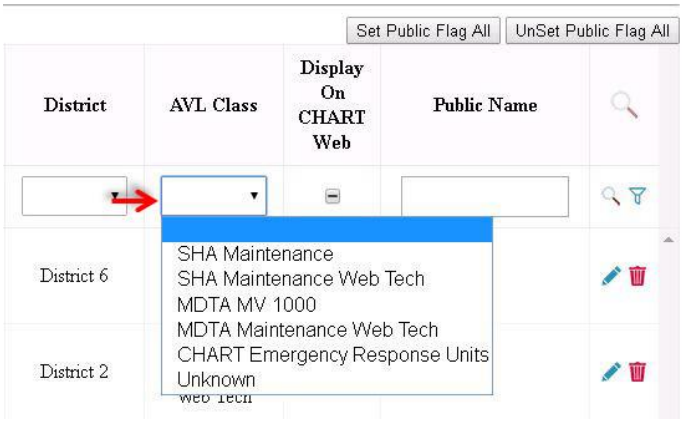


Figure 4-6 Filter AVL Vehicles By AVL Class

The user may clear the individual filter for AVL Class by selecting the blank option, or by clearing all filter fields with the Clear Filter icon at the end of the filter row.

4.1.5 Set Public Display Flag For All Vehicles

On the Devices and MV Devices List pages, a new button is added: **Set Public Flag All**. This button allows the user to activate the Public Display Flag for all vehicles, or a select number of vehicles using a specific filter. When the Set Public Flag All button is clicked and a current filter is entered for the District and/or AVL Class, only vehicles matching the values of these two filter fields will have their Public Display Flag activated. All other filter fields are ignored when clicking the Set Public Flag All button.
Note: A page refresh will occur automatically after the Set Public Flag All button is pressed, and the current filter will be cleared.

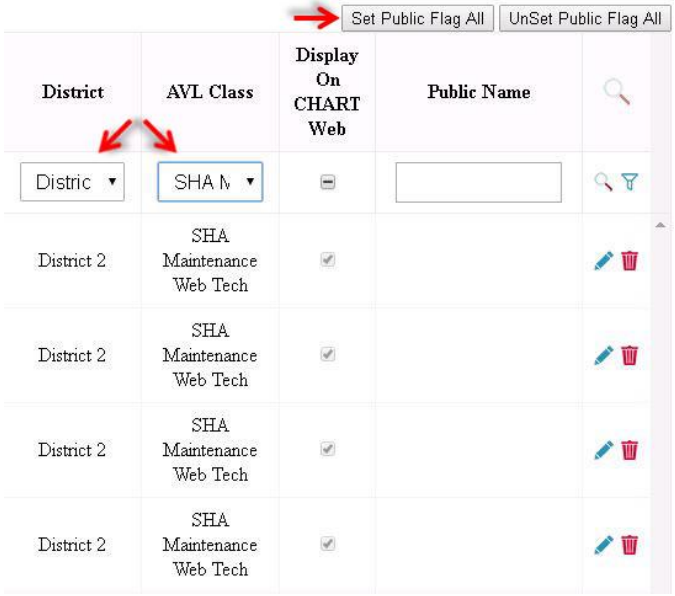


Figure 4-7 Set Public Display Flag For All Vehicles

4.1.6 Unset Public Display Flag For All Vehicles

On the Devices and MV Devices List pages, a new button is added: **Unset Public Flag All**. This button allows the user to deactivate the Public Display Flag for all vehicles, or a select number of vehicles using a specific filter. When the Unset Public Flag All button is clicked and a current filter is entered for the District and/or AVL Class, only vehicles matching the values of these two filter fields will have their Public Display Flag deactivated. All other filter fields are ignored when clicking the Unset Public Flag All button.
Note: A page refresh will occur automatically after the Unset Public Flag All button is pressed, and the current filter will be cleared.

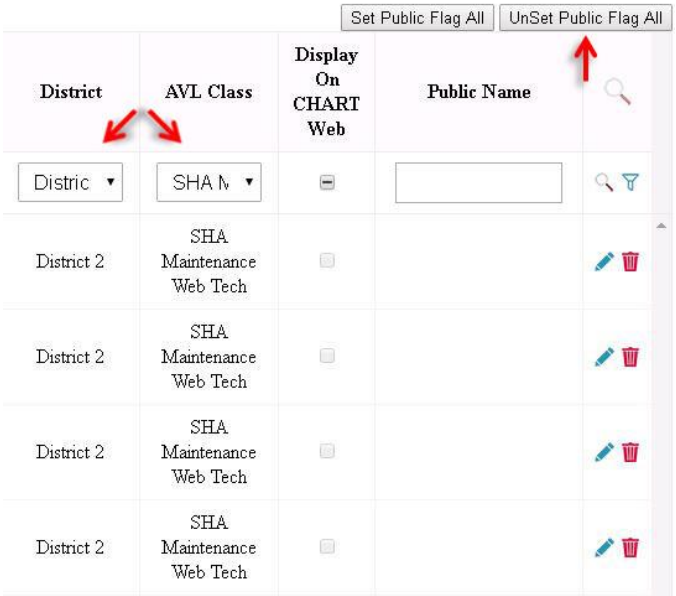
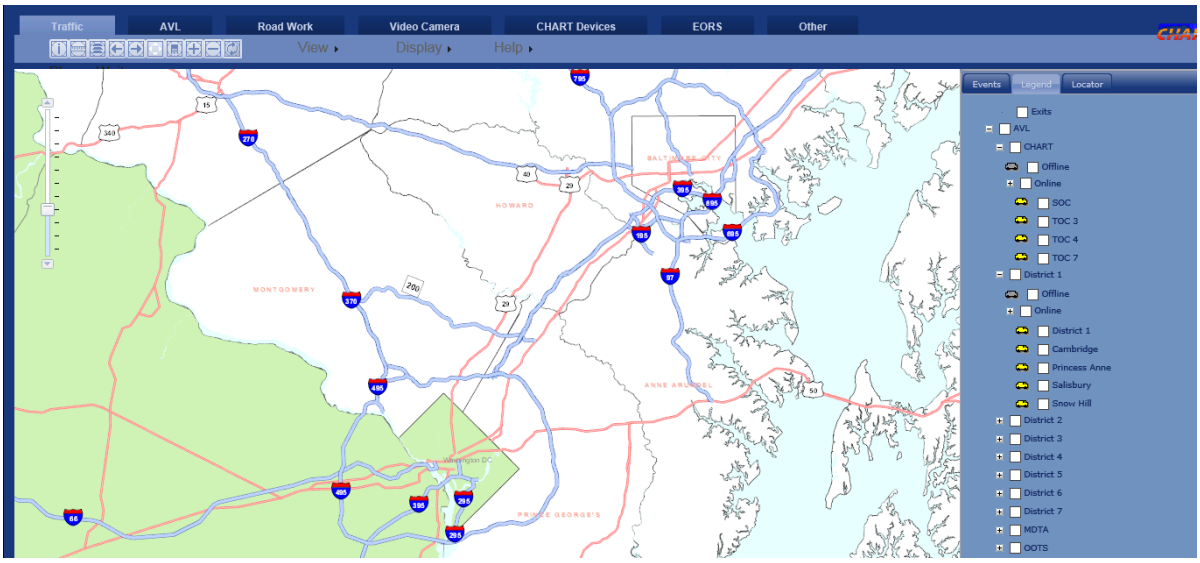


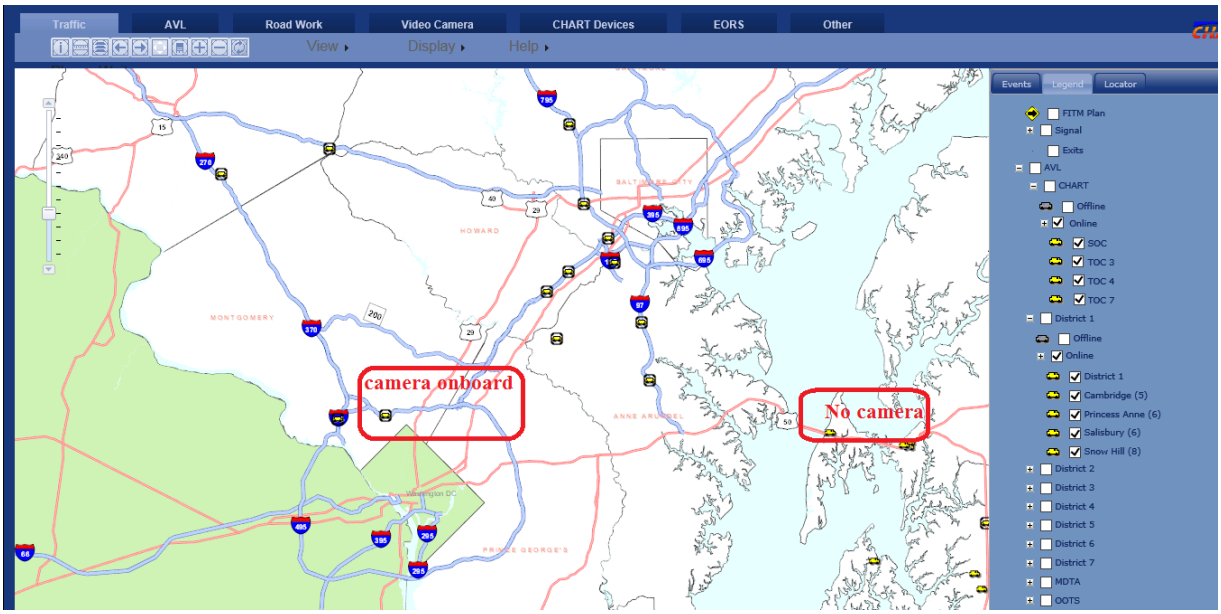
Figure 4-8 Unset Public Display Flag For All Vehicles

4.2 Intranet Map

A change has been made to the Intranet Map legend for the CHART Online layers to use the same icon as the other online layers.



Any AVL vehicles that support a live video stream feed will be shown on the map with a circle around them. The operator can easily identify these vehicles from other AVL vehicles that do not have camera onboard.



4.3 CHART Web

4.3.1 Provide users the ability to select either a Hybrid layer or a Google Map layer as base layer

This section describes the new interface features added. Google Map and Google Hybrid layers are the only two layers used in this interface. Users can select either of

the layers to view the winter vehicles. The default layer is the Google Street Layer as shown in fig 4-11.

Figure 4-11 Layers

4.3.2 Update Winter Operations Vehicles to display icons on the Winter Operations Vehicles Map

The Winter Operations Vehicles Map, will only display vehicles as icons in only two formats - vehicles with black circle, and vehicles without black circle as shown on fig.4.12. The Winter Vehicles map interface consumes a JSON feed received from the CHARTExporter

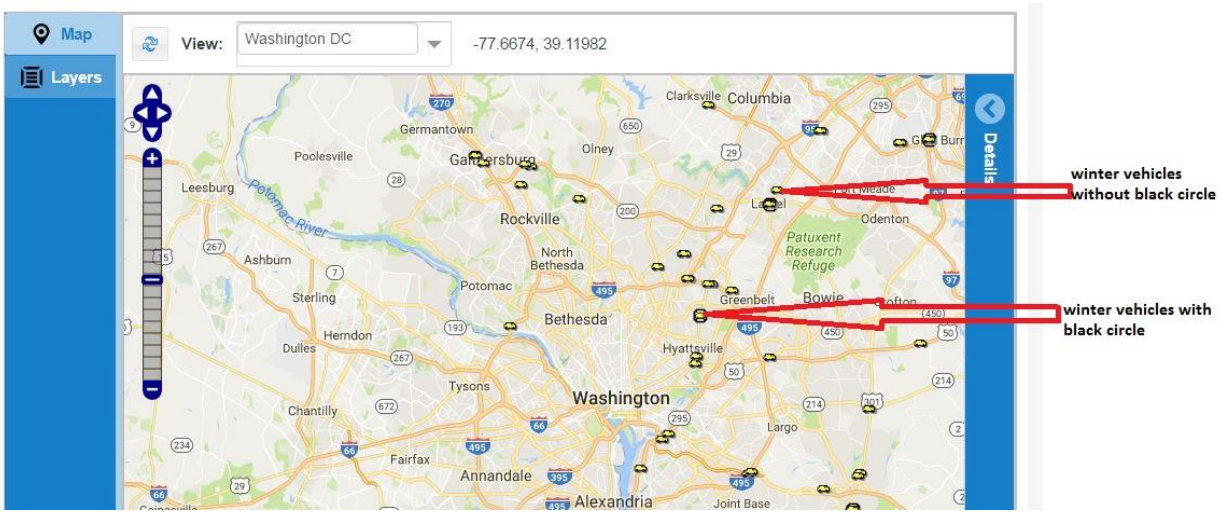


Figure 4-12 Winter Operations Map with vehicles as icons

4.3.3 Provide no streaming videos for icons without black circle on the winter Operations Vehicles Map.

Winter Operations Vehicles without black circle are the vehicles not equipped with streaming videos as shown on fig 4-13. When a user clicks on the vechicle, a detailed page is displayed showing the name of the vehicle and Last Reported Time. The Winter Vehicles map interface consumes a JSON feed received from the CHARTExporter. One of the information received is a publicVideoURL. The feed with no publicVideoURL will be represented on the map without a black circle.

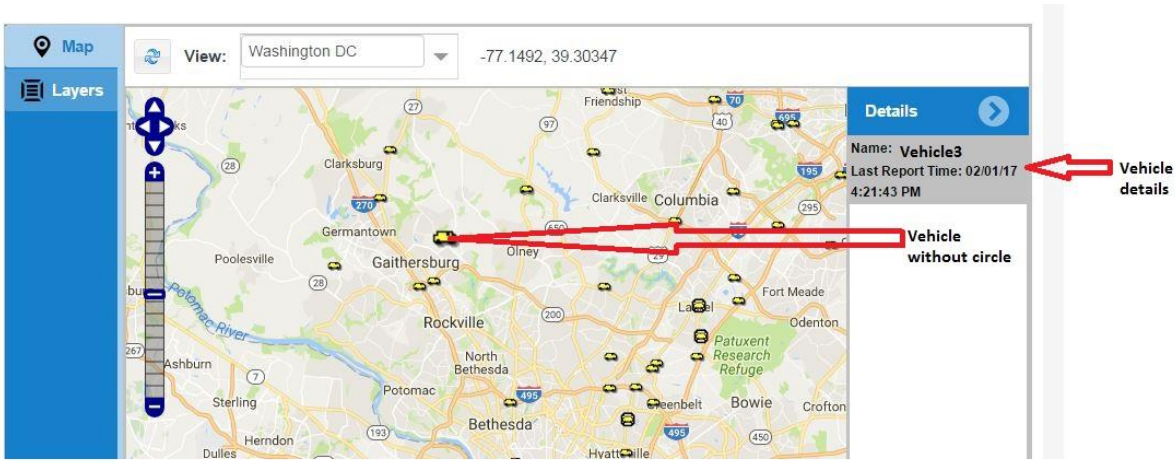


Figure 4-13 Winter Operations Vehicles without black circle

4.3.4 Provide users the ability to click on an icon with a black circle on the winter Operations Vehicles Map to view streaming video in a pop-up window

Winter Vehicles with black circle are the vehicles equipped with streaming videos as shown on fig 4-14. When a user clicks on the vechicle, a video pop up is displayed, and a detailed page is displayed showing the name of the vehicle, Last Reported Time, and a view link. The video pop up is shown in fig 4-15. The Winter Vehicles map interface consumes a JSON feed received from the CHARTExporter. One of the information received is a publicVideoURL. The feed with publicVideoURL will be represented on the map with a black circle.

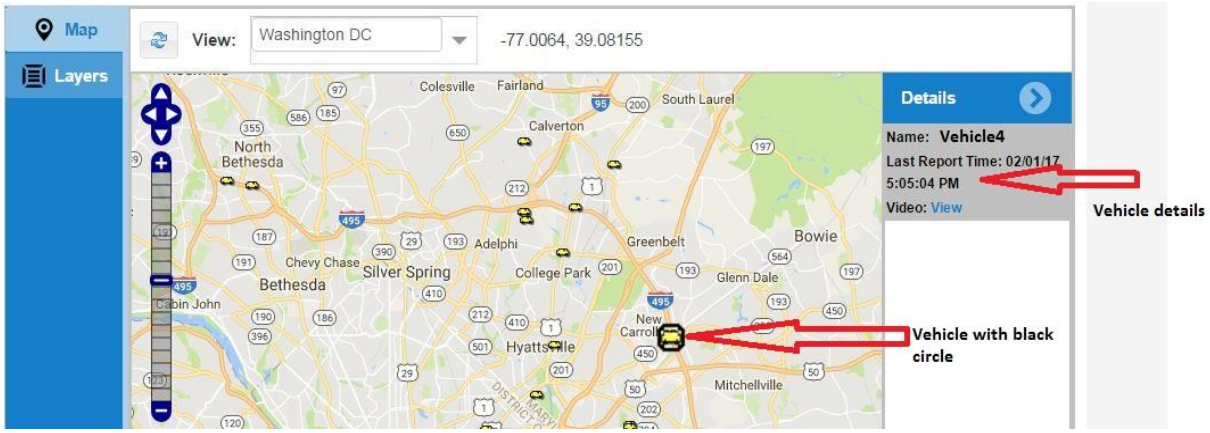


Figure 4-14 Winter Operations Vehicles with black circle

Figure 4-15 Pop up video from Vehicle with with black circle

4.3.5 Provide Winter Operation Vehicles map the ability to receive and display CHARTWeb Messages from EORS Application

Winter Operations Vehicles map will be to receive EORS Application messages and display it through its interface. The messages are received in the CHARTWeb database first and then displayed as shown on Fig 4.16

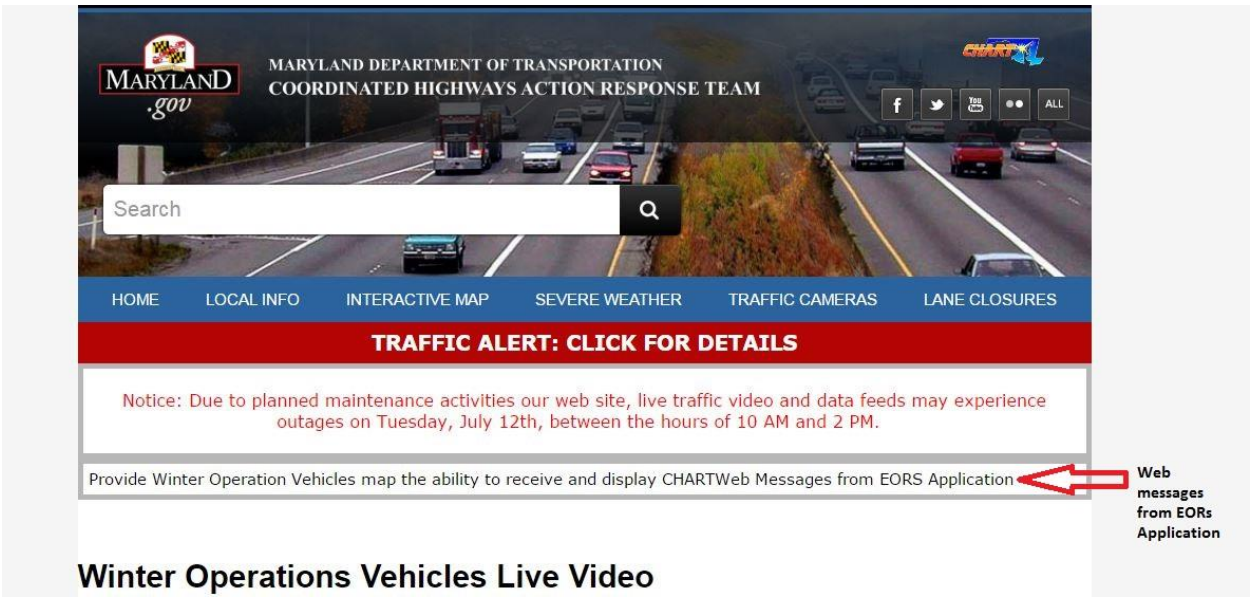


Figure 4-16 A sample web message from EORS Application

5 DETAILED DESIGN

5.1 Hardware Detailed Design

There is no new hardware (servers, devices, etc.) deployed that is related to WO12.

5.2 Software Detailed Design

5.2.1 Key Design Concepts

5.2.1.1 WO12 GPS Server

- The internal Postgres database on the AVL GPS Server is updated to persist the new fields for Public Display Flag and Public Display Name. The existing Python Postgres DB driver classes are updated to handle modifications to these fields.
- Requests to the XML Soap Request Server for TdxDevice and TdxGPS data updates will now include the fields for public display flag and name. The public display flag field will always be present as a boolean value in the request, and contain the most recent cached value from the database. The initial value of the public display name field for a device added from webtech will be null, and thus is initially omitted from the XML Soap response. Any subsequent updates to the public name field by the user will either provide a valid entry or an empty string in the response.
- The existing Rest API handler for the AVL GPS Server interface pages will now handle user edits to the public display flag and name, and requests for filtering. A new Rest API call is also added to handle AJAX calls for activation and deactivation of the public display flag for all devices in a current District and/or AVL Class filter.

5.2.1.2 WO12 AVL Client

- MAP-558 adds a replacement of the AVL client.
- The AVL client includes the addition of newer fields that are being imported from the GPS server.
- The PR addresses occasional erratic behavior of the AVL client that has been observed in production.
- The changes made to the AVL client are seamless and the mechanism used by CHART applications to retrieve the imported data is unaffected.

5.2.1.3 WO12 Intranet Map

- The legend for the Online CHART layers has been changed to use the same icon as the other district online layers.
- Any Online vehicle that supports streaming of live video feed will be shown with a circle around the icon on the map.

5.2.1.4 WO12 CHART Export Client

- The new AVL JSON datafeed is modeled after the exiting RWIS (and other datafeeds).
- External host sfs ip addresses for CCTV associated with AVL vehicles will be assigned a default value in the datafeed that is specified in the CHARTExportClient properties file. This value may be overridden by inserting a row in the avl_sfs_lkl table (CHARTWeb DB) containing the cctv id (32 byte) and the ip.
- Only AVL Vehicles reporting within the last 20 minutes will be available in the datafeed. The 20 minute time period is configurable in the CHARTExportClient properties file.
- The cached data providing AVL data for the datafeed is refreshed from the DB every 60 seconds. The 60 second time period is configurable in the CHARTExportClient properties file.

5.2.1.5 WO12 CHART Web

CHARTWeb will be modified to provide a new page, the Winter Operations Vehicles Video map to show those vehicles designated for display to the public. This page will have the ability to display specific messaging at the top. Video will be available for any video-equipped vehicles displaying. CHARTweb users will get the actual AVL data from the CHART ExportClient AVL JSON data feed.

5.2.2 Packaging

5.2.2.1 CHART ATMS

This software design is broken into packages of related classes. Table 5-1 shows each package that is new or changed to support the Release 17 features.

Table 5-1. CHART ATMS Packages

Package Name	Package Description
CHART2.webservices.exportlistenermodule	Added functionality for the new AVL JSON datafeed.

5.2.2.2 GPS Server

This software design is broken into python scripts of specific functions. Table 5-1 shows each script that is new or changed to support the WO 12 features.

Table 5-2. GPS Server Scripts

Script/Folder Name	Package Description
AVL	Updates to db and cache for fields of public display flag, name
DEVICES_REST_API	Updated with new handler for set/unset public flag all, and filtering requests
XMLSOAPRPCSERVER	Updated with fields for public display flag, name in requests
Dir: Static	Multiple updates for web interface changes

5.2.2.3 CHARTWeb

The Winter Operations VehiclesVideo map is deployed as a new CHARTWeb package. Table 5-1 shows directories that are new or have changed code to support the WO 12 features.

Table 5-3 CHARTWeb updates

Folder Name	Package Description
Webroot/WinteroperationsVehiclesMap*	All elements for WinterOperationsVehiclesVideo map
Webroot/StormInfo	Link to new Winter Operations Vehicles Video map
Webroot/map	Link to new Winter Operations Vehicles Video map

5.2.2.4 CHART Mapping

There were changes made to the AVL Client and to the Intranet map. Table 5-14 shows directories that are new or have changed code to support the WO 12 features.

Table 5-3 CHART Mapping updates

Folder Name	Package Description
Source/Web/CHARTMap/CHARTAVLClient/CHARTAVLClient/*	Deleted for MAP-558 – AVLClient repackaging.
Source/Web/CHARTMap/AVLClient/*	All elements for AVLClient updates for MAP-558 and to read and write new AVL SOAP elements.
Source/Web/CHARTMap/CHARTMapWeb/CHARTMapWebSolution/src/CHARTMapWebSrc/js	Intranet map updates
Source/Web/MapDocument/imap/CHARTAVL_REST.mxd	AVL REST update
Source/Web/MapDocument/CHARTAVL.mxd	AVL mxd update
Source/Web/CHARTMap/scripts/G_vehicle_cleanup.py	Clean up older vehicles

5.2.3 Assumptions and Constraints

The software may be deployed regardless of whether new equipment is installed in the vehicles.

There is an assumption at initial deployment, vehicles will have no public name and none will be configured to be displayed to the public. The public name will need to be configured by CHART operations.

5.2.4 Use Case Diagrams

Because of the nature of WO12, no Use Case Diagrams were done.

5.2.5 System Interfaces Design (IDL)

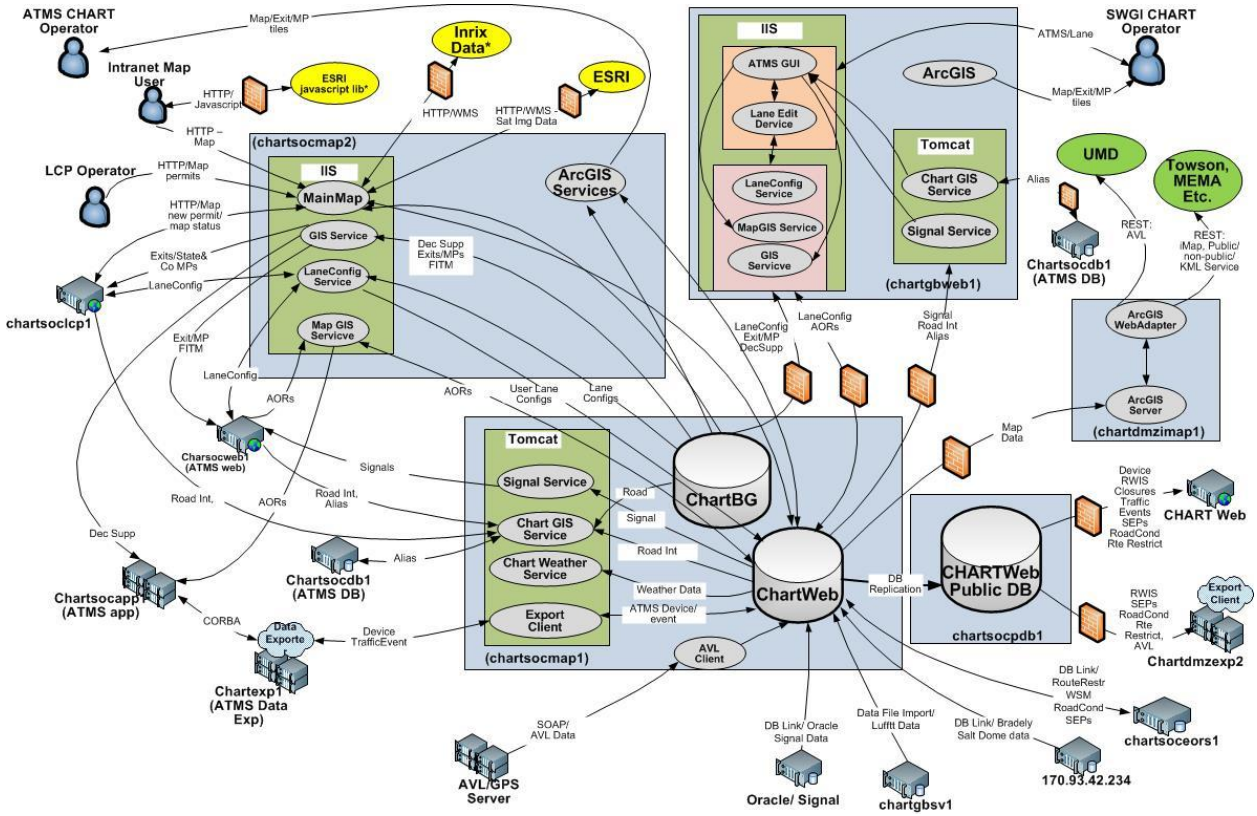
N/A for WO12.

5.2.6 Package Designs

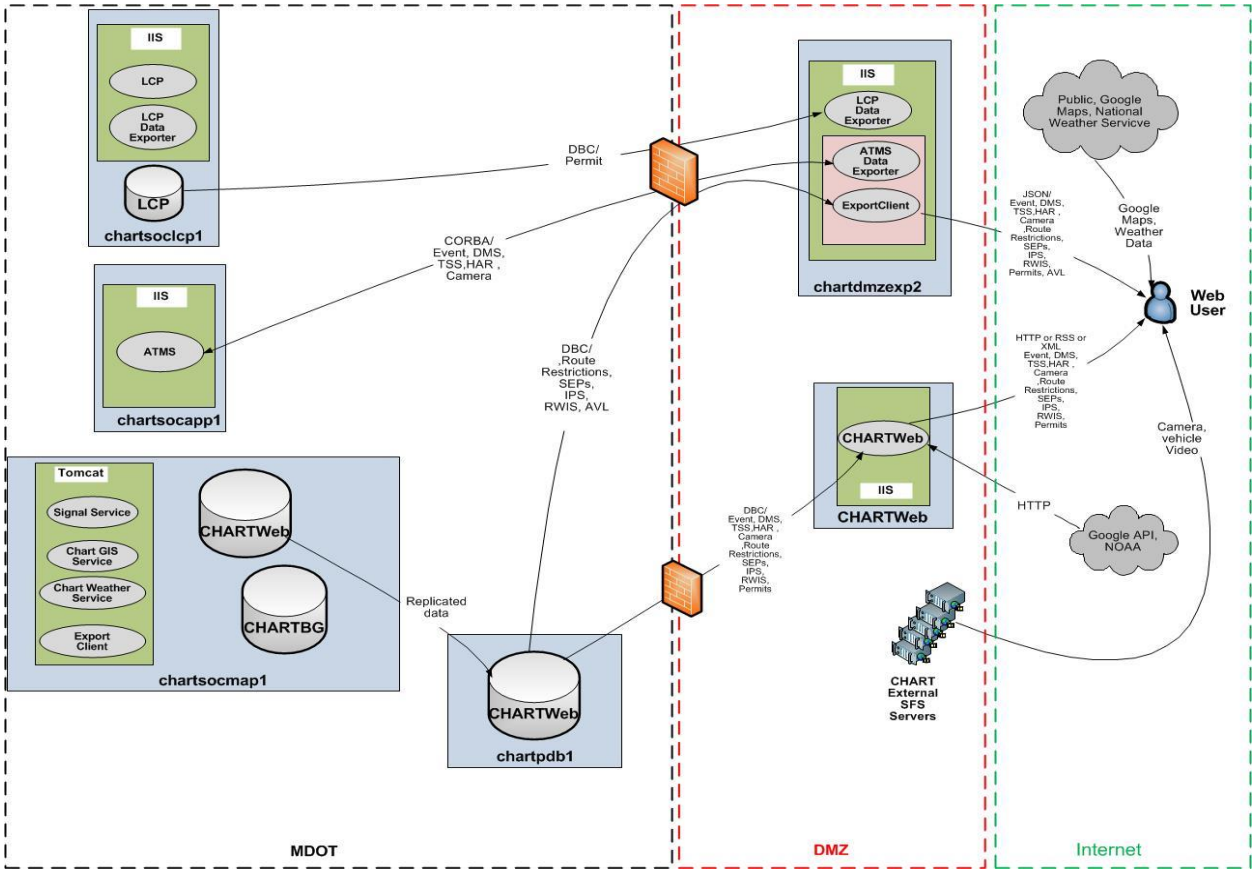
N/A for WO12.

5.3 Internal Communications Detailed Design

The following diagrams show where there have been updates to data connections among CHART components. At a high level, the CHARTExportClient now reads AVL data from the chartsocpublicd CHARTWeb database and serves that data as JSON for CHARTWeb Winter Operations vehicles Video map users. These changes are portrayed in the Mapping and CHARTweb detailed architecture diagrams. Note that there are no real data flow architecture changes for the AVL GPS Server. Also, the new AVL data feed for the CHART Export Client is shown in both the Mapping and CHARTWeb diagrams below.



5-1 CHART Mapping Detailed Data Flow



5-2 CHARTWeb Detailed Data Flow

6 EXTERNAL INTERFACES

This section describes the external interfaces utilized by CHART. There are no external interfaces being added or modified in WO12. All modifications are to internal CHART interfaces. However, there are modified interfaces that are "external" to affectd CHART applications. Those are depicted below. See Figure 6-1.

6.1 Interface Architecture

Sections below describe where interfaces have changed for affected applications. In this case it is ATMS and CHARTWeb.

6.1.1 Interface Architecture – CHART Mapping

There are no interface changes per se. However, the diagram has been updated to portray that the CHARTExportClient reads from Mapping (reads from the CHARTWeb DB) and now reads AVL data. All of the CHARTExport client data is made available to CHARTWeb users as JSON. So, the CHARTExportClient is shown in this Mapping diagram.

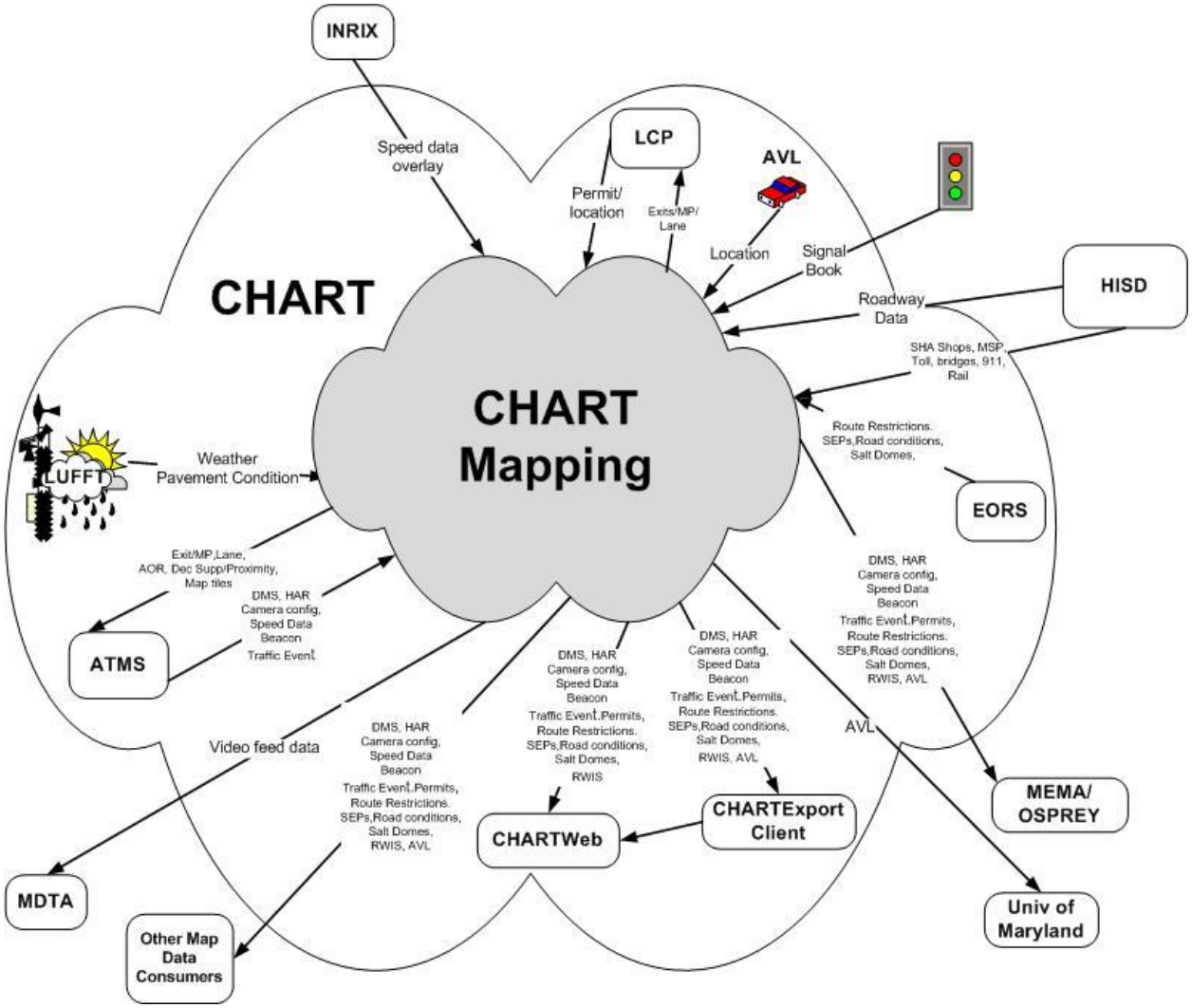


Figure 6-1. CHART Mapping and External Interfaces

6.1.2 Interface Architecture – AVL GPS Server

There are no interface changes per se. However, the diagram has been updated to portray that the CHARTExportClient reads from Mapping (reads from the CHARTWeb DB) and now reads AVL data that is made available to CHARTWeb users as JSON.

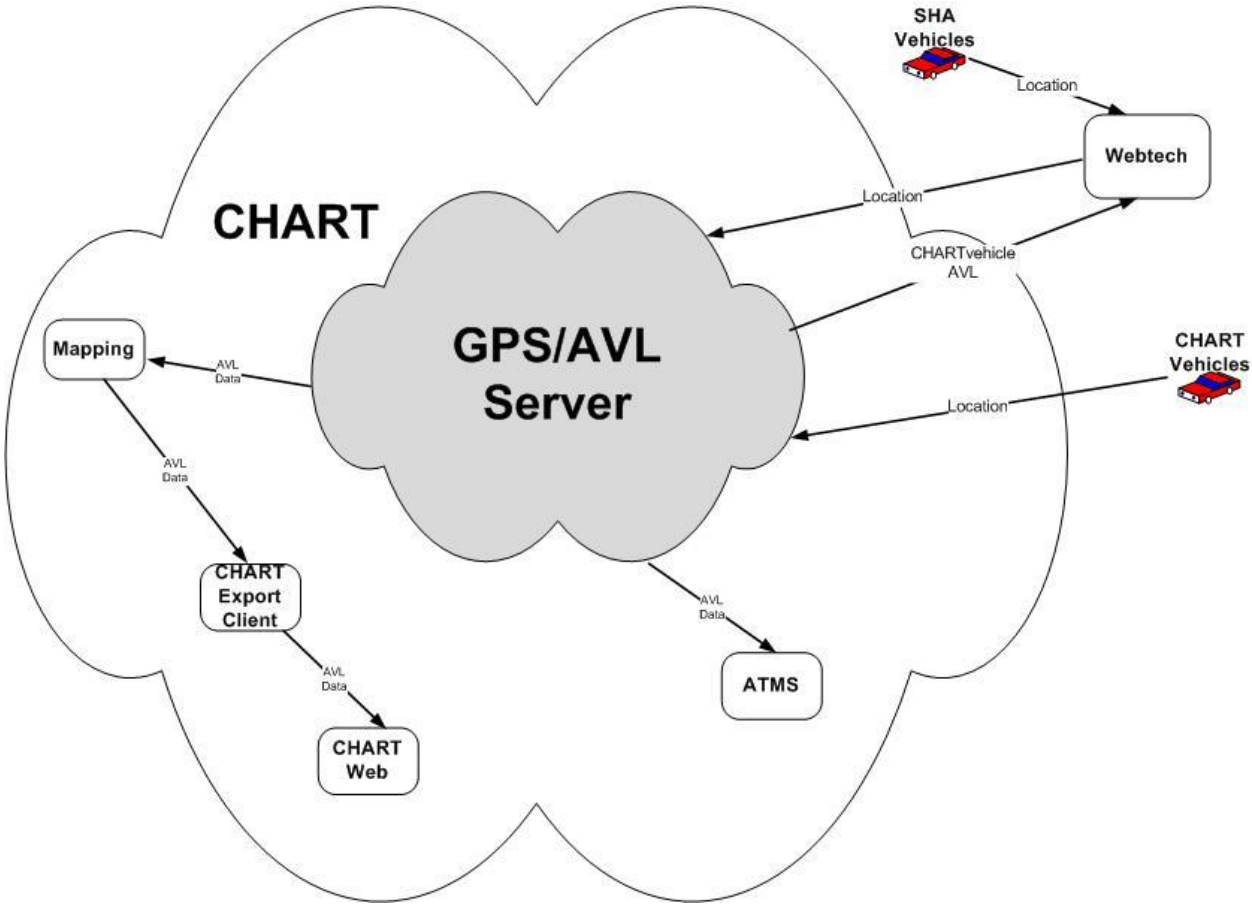


Figure 6-2. CHART Mapping and External Interfaces

6.1.3 Interface Architecture – CHARTWeb

The diagram below depicts that no the exportClient makes AVL data available to CHARTWeb users.

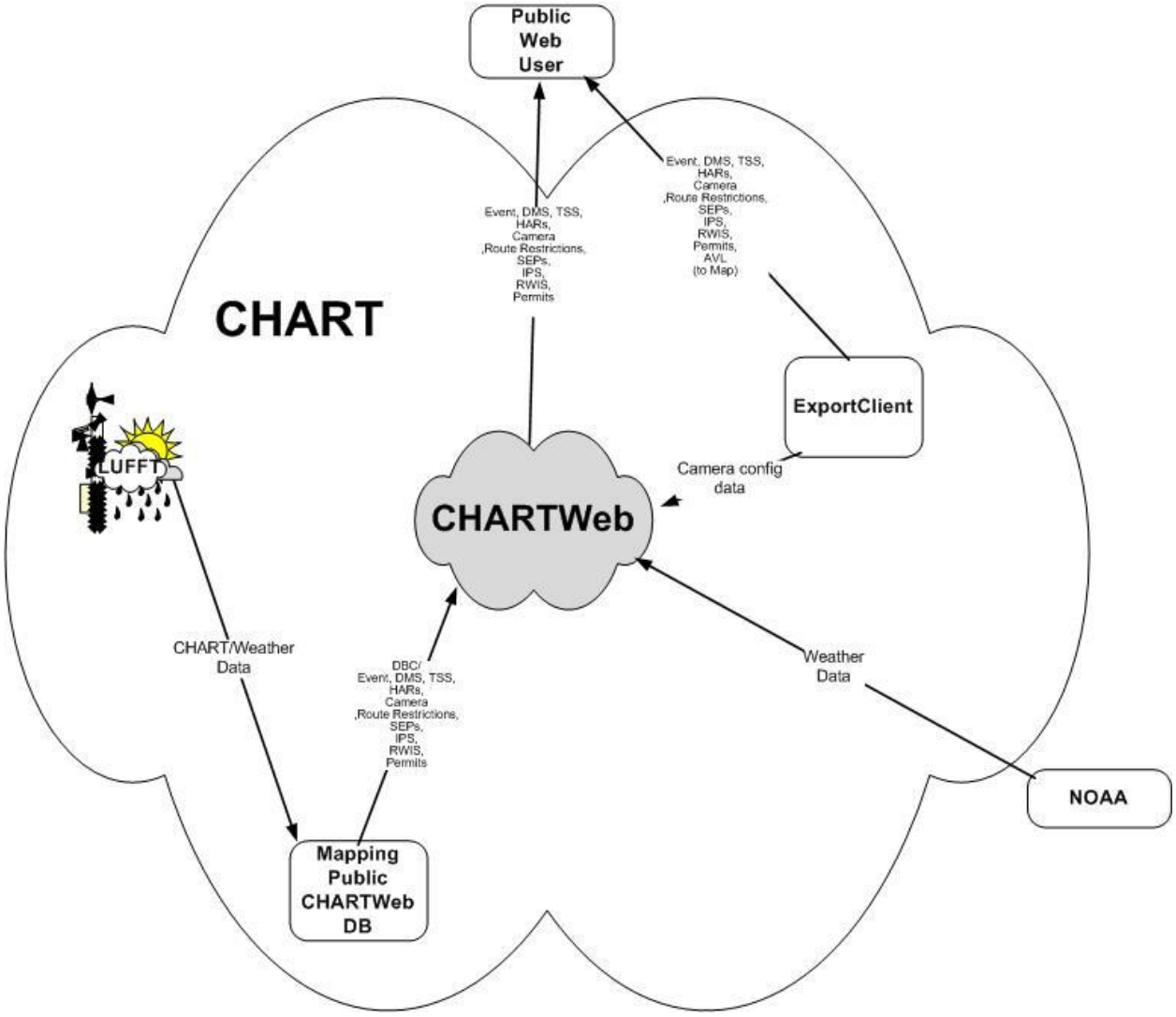


Figure 6-3. CHARTWeb and External Interfaces

6.1.4 Interface Architecture – ATMS

There are no changes to the ATMS external interface diagram. The diagram is presented below.

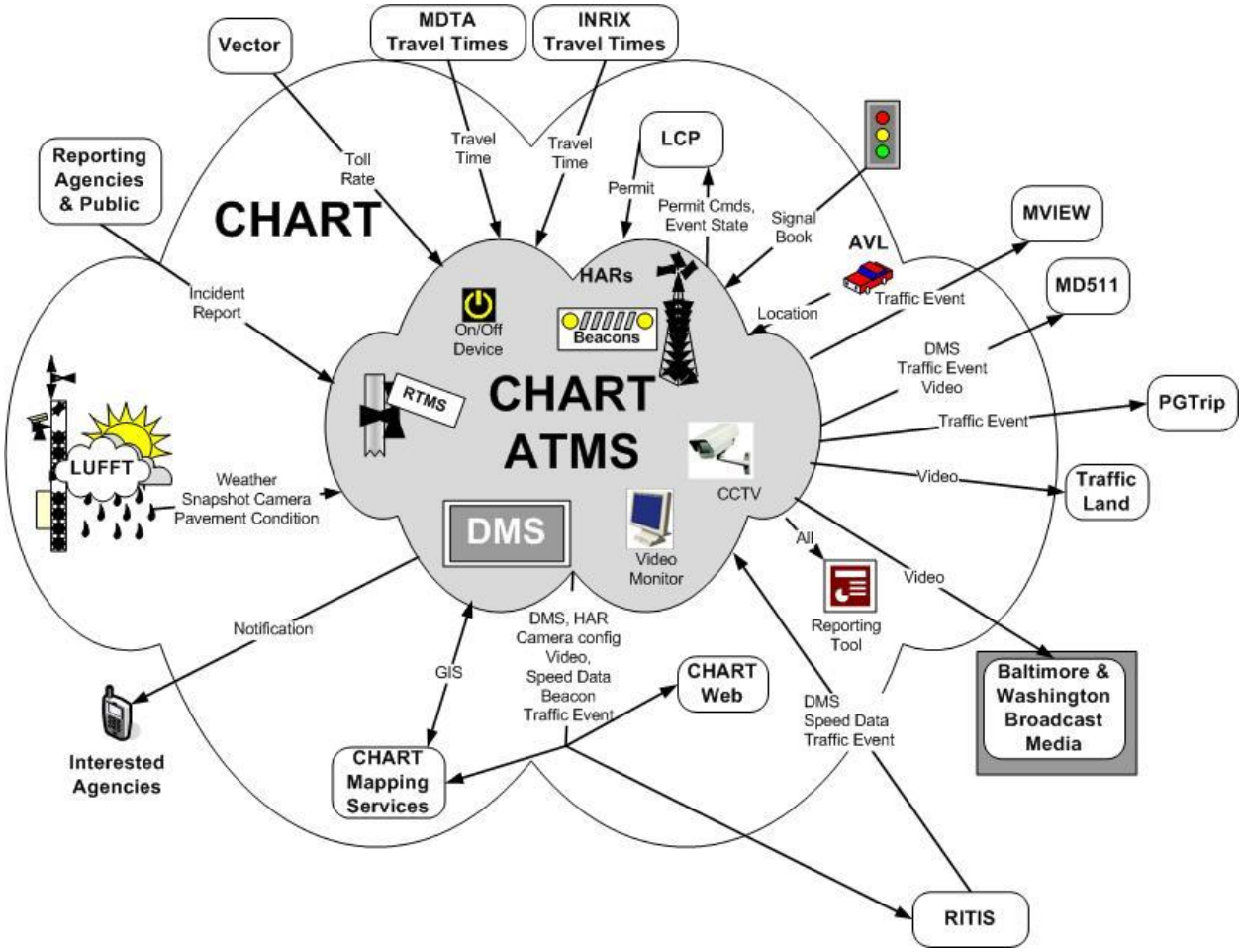


Figure 6-4. ATMS and External Interfaces

6.2 Interface Detailed Design

For WO12, there are no changes to the external interfaces.

7 SYSTEM INEGRITY CONTROLS

This section describes the security and integrity controls being added or modified in WO12. Features being added for WO12 do not change security aspects of the CHART System.

APPENDIX A. MAPPING TO REQUIREMENTS

The table below shows how the requirements in the WO12 Requirements document map to design elements contained in this design.

Table A-1. Mapping to Requirements

Requirements Doc Use Case / PR	Description	Features	Use Case Diagram	Other Design Elements
UC-1.0	GPS Server: Update Public Display and Name Fields	N/A	N/A	Section 5.2.1.1 Key Design Concepts - WO12 GPS Server
UC-2.0	GPS Server: Filter Vehicles By AVL Vehicle Class	N/A	N/A	Section 5.2.1.1 Key Design Concepts - WO12 GPS Server
UC-3.0	GPS Server: Filter Vehicles By District	N/A	N/A	Section 5.2.1.1 Key Design Concepts - WO12 GPS Server
UC-4.0	AVL Client: Update AVL vehicle data in CHARTWeb Database obtained from GPS Server SOAP Web Service	N/A	N/A	Section 5.2.1.2 Key Design Concepts - AVL Client
UC-5.0	Export Client: Provide AVL Vehicle JSON Data Feed from CHART Export Client	N/A	N/A	Section 5.2.1.4 Key Design Concepts - WO12 CHART Export Client
UC-6.0	Intranet Map: Display the new MV1000 vehicles	N/A	N/A	Section 4.2, 5.2.1.3
UC-7.0	CHARTWeb: Update Winter Operations Vehicles to display icons on the Winter Operations Vehicles Map	N/A	N/A	Section 4.3.2, 5.2.1.5

Requirements Doc Use Case / PR	Description	Features	Use Case Diagram	Other Design Elements
UC-8.0	CHARTWeb: Provide users the ability to click on an icon with black circle on the winter Operations Vehicles Map to view streaming video in a pop-up window	N/A	N/A	Section 4.3.4, 5.2.1.5
UC-9.0	CHARTWeb: Provide no streaming videos for icons without black circle on the winter Operations Vehicles Map.	N/A	N/A	Section 4.3.3, 5.2.1.5
UC-10.0	CHARTWeb: Provide users the ability to select either a Hybrid layer or a Google Map layer as base layer to display winter operation vehicles icon.	N/A	N/A	Section 4.3.1, 5.2.1.5
UC-11.0	CHARTWeb: Provide Winter Operation Vehicles map the ability to receive and display CHARTWeb Messages from EORS Application.	N/A	N/A	Section 4.3.5, 5.2.1.5